CLAIMS

What is claimed is:

1. An electronic ballast for use in illuminating a lamp, comprising:

a lamp driving circuit having a pulse-width modulated signal generator;

a timing capacitor coupled to the lamp driving circuit; and

a power controller that compares a signal associated with a current flowing through the lamp to a signal associated with a desired lamp current and based on the comparison provides a correction current to the timing capacitor to control a duty cycle of an output of the pulse-width modulated signal generator.

2. The electronic ballast of claim 1, wherein the power controller includes a current sense resistor that detects the current flowing through the lamp and an operational amplifier circuit that compares a voltage developed across the current sense resistor to a reference voltage associated with the desired lamp current.

3. The electronic ballast of claim 2, wherein the operational amplifier circuit includes a capacitor connected between an output terminal of the operational amplifier and an inverting input of the operational amplifier.

4. The electronic ballast of claim 1, wherein the pulse-width modulated signal generator further includes:

a latch circuit having first and second inputs and first and second outputs, wherein the first and second outputs are logical complements of each other;

a first comparator having a first input terminal coupled to a first reference voltage, a second input terminal coupled to the timing capacitor and an output terminal coupled to the first input of the latch; and

a second comparator having a first input terminal coupled to a second reference voltage that is different from the first reference voltage, a second input terminal coupled to the timing capacitor, and an output terminal coupled to the second input of the latch, wherein the first and second comparators cause the logical state of the first and second latch outputs to change in response a voltage across the timing capacitor.

5. The electronic ballast of claim 4, wherein the lamp driving circuit includes a current source and a switch coupled to the current source and the timing capacitor, wherein the operation of the switch is controlled by one of the first and second outputs of the latch to discharge the timing capacitor.

6. The electronic ballast of claim 1, wherien the lamp driving circuit further includes:

a lamp drive starter circuit coupled to a supply voltage that enables the operation of the lamp driver circuit when the supply voltage exceeds a predetermined level;

a soft starter circuit coupled to the lamp drive starter circuit;

a reference current circuit that provides a reference current to the soft starter circuit;

a pulse-width modulated signal splitter coupled to the lamp drive starter circuit and the pulse-width signal generator;

a sawtooth oscillator; and

an adder coupled to the timing capacitor, the pulse-width modulated signal generator, the sawtooth oscillator and the soft starter circuit, wherein the adder generates a charging current for charging the timing capacitor.

7. An electronic ballast system, comprising:

a voltage source for supplying power to the electric ballast system;

a lamp driving circuit having a first terminal, a second terminal, and a third terminal, the power of the voltage source being supplied through the first terminal to begin the driving of the electronic ballast system, and the lamp driving circuit outputting pulse-width modulated signals through the second and third terminals;

a half bridge converter, a first end of which is connected to the second terminal of the lamp driving circuit and a second end of which is connected to the third terminal of the lamp driving circuit, the half bridge converter receiving input from the second and third terminals of the lamp driving circuit, and the half bridge converter outputting a current which changes flow directions according to the pulse-width modulated signals output by the lamp driving circuit;

a lamp portion, a first end of which is connected to an output end of the half bridge converter, the lamp portion operating according to the current output by the half bridge converter; and

a power controller connected between the lamp driving circuit and a common terminal of the half bridge converter and the lamp portion, the power controller detecting an amount of current supplied to the lamp portion and controlling a drive frequency of the lamp driving circuit based on the detected amount of current to control an output power of the lamp portion.

8. The electronic ballast system of claim 7, further comprising:

a first resistor connected between the voltage source and the first terminal of the lamp driving circuit;

a first capacitor connected between a ground potential and the first terminal of the lamp driving circuit, the first capacitor being charged by a current input through the first resistor; and

a diode connected between a ground potential and the first terminal of the lamp driving circuit, the diode acting to maintain a charge voltage of the first capacitor above a predetermined potential.

9. The electronic ballast system of claim 7, wherein the lamp driving circuit comprises:

a reference current generator for generating and outputting a reference current;

a lamp drive starter for receiving the power of the voltage source through the first terminal of the lamp driving circuit to begin the operation of the lamp driving circuit;

a soft starter receiving a starting signal from the lamp drive starter and the reference current from the reference current generator, and outputting a lamp initial drive current to soft start the lamp;

a sawtooth oscillator for outputting a sawtooth wave current;

an adder receiving the lamp initial drive current from the soft starter and the sawtooth wave current from the sawtooth oscillator, and adding the lamp initial drive current to the sawtooth wave current and outputting a resulting output current;

a first current source connected to the adder to receive the output current of the adder, the first current source selectively dividing the output current of the adder;

a pulse-width signal generator connected to the adder and the first current source, receiving the output current of the adder, and generating and outputting pulse-width modulated signals; and

a pulse-width modulated signal splitter receiving the output pulse-width modulated signals from the pulse-width modulated signal generator and alternately splitting and outputting the pulse-width modulated signals through the second and third terminals of the lamp driving circuit.

10. The electric ballast system of claim 9, further comprising:

a second capacitor connected between the soft starter and a ground potential, the second capacitor determining a soft starting time;

a third capacitor connected between the ground potential and a common terminal of the adder and the pulse-width modulated signal generator, the third capacitor determining a frequency of the pulse-width modulated signals; and

a second resistor connected between the reference current generator and the ground potential, the second resistor determining a magnitude of the reference current output by the reference current generator.

11. The electronic ballast system of claim 10, wherein the soft starter comprises:

a first switch connected between the ground potential and the second capacitor, the first switch being controlled to ON if the starting signal of the lamp drive starter is generated, thereby reducing a charge voltage of the second capacitor;

a subtractor connected to a common terminal of the first switch and the second capacitor, the subtractor generating a difference between a reference voltage and the charge voltage of the second capacitor and outputting an output voltage corresponding to the difference; and

a multiplier receiving the output voltage of the subtractor and the reference current of the reference current generator and multiplying the output voltage of the subtractor by the reference current of the reference current generator.

12. The electronic ballast system of claim 11, wherein the pulse-width modulated signal generator comprises:

a first comparator receiving a charge voltage of the third capacitor through a first terminal and a first potential through a second terminal, the first comparator comparing the charge voltage of the third capacitor with the first potential and outputting a first comparison value;

a second comparator receiving the charge voltage of the third capacitor through a second terminal and a second potential through a first terminal, the second comparator comparing the charge voltage of the third capacitor with the second potential and outputting a second comparison value; and

a latch receiving the first and second comparison values and outputting a latching value based thereon.

13. The electric ballast system of claim 7, wherein the half bridge converter comprises:

a transformer having a primary winding, a first end of the primary winding being connected to the second terminal of the lamp driving circuit and a second end of the primary winding being connected to the third terminal of the lamp driving circuit, and having first and second secondary windings through which the pulse-width modulated signals of the lamp driving circuit are alternately output;

a first metal oxide semiconductor transistor (MOSFET) having a source terminal connected to the voltage source, a gate terminal connected to a first end of the first secondary winding, and a drain terminal connected to a second end of the first secondary winding of the transformer, the first MOSFET performing switching according to an output waveform of the first secondary winding of the transformer; and

a second MOSFET having a drain terminal connected to a common terminal of the drain terminal of the first MOSFET and the first secondary winding of the transformer, a gate terminal connected to a first end of the second secondary winding of the transformer, and a source terminal connected to a second end of the second secondary winding of the transformer, the second MOSFET performing switching according to an output waveform of the second secondary winding of the transformer.

14. The electronic ballast system of claim 13, further comprising:

a third resistor connected between the first secondary winding of the transformer and the gate terminal of the first MOSFET, the third resistor preventing an excess current from flowing to the first MOSFET; and

a fourth resistor connected between the second secondary winding of the transformer and the gate terminal of the second MOSFET, the fourth resistor preventing an excess current from flowing to the second MOSFET.

15. The electronic ballast system of claim 14, wherein the lamp portion comprises:

an inductor connected to a common terminal of the first MOSFET and the second MOSFET;

a lamp, a first end of which is connected to the inductor;

a fourth capacitor connected across the lamp;

a fifth capacitor connected between a second end of the lamp and a common terminal of the voltage source and the first MOSFET; and

a sixth capacitor connected between the source terminal of the second MOSFET and a common terminal of the second end of the lamp and the fourth capacitor.

16. The electronic ballast system of claim 15, wherein the power controller comprises:

a fifth resistor connected between a ground potential and a common terminal of the sixth capacitor and the second MOSFET, the fifth resistor detecting the current supplied to the lamp portion; and

a frequency controller connected to the fifth resistor, a common terminal of the second resistor and the reference current generator, and the third capacitor, the frequency controller comparing a voltage detected at one end of the fifth resistor with a voltage at the common terminal of the second resistor and the reference current generator, and increasing the drive frequency of the lamp driving circuit if the voltage at the one end of the fifth resistor is larger and decreasing the drive frequency of the lamp driving circuit if the voltage at the one end of the fifth resistor is smaller.

17. The electronic ballast system of claim 16, wherein the frequency controller comprises:

a sixth resistor connected to a common terminal of the fifth resistor and the sixth capacitor;

a seventh resistor, a first end of which is coupled to the ground potential;

a seventh capacitor connected in parallel to the first end and a second end of the seventh resistor;

an eighth resistor connected between the common terminal of the second resistor and the reference current generator and the second end of the seventh resistor;

a ninth resistor, one end of which is connected to a common terminal of the seventh resistor, the eighth resistor, and the seventh capacitor;

an amplifier, a first terminal of which is connected to the sixth resistor and a second terminal of which is connected to the ninth resistor;

a tenth resistor connected between an output terminal of the amplifier and a common terminal the third capacitor, the adder, and the pulse-width signal generator; and

an eighth capacitor connected between the second terminal of the amplifier and the output terminal of the amplifier.